the ILLINOIS ENGINEER

76th I.S.P.E. Board of Direction

THE ILLINOIS ENGINEER
SEPTEMBER, 1960
VOLUME XXXVI, NO. 9

THE
ILLINOIS ENGINEER
ILLINOIS SOCIETY OF PROFESSIONAL ENGINEERS, Incorporated
Affiliated with the National Society of Professional Engineers
PROGRESS TOMORROW THROUGH BETTER ENGINEERING TODAY!

CHAPTER OFFICERS FOR 1960

CHAPTER	PRESIDENT	VICE-PRESIDENT	SECRETARY-TREASURER
Ambraw	H. K. Dolbow	Ralph E. Hedgcock	Earl Moldovan
Bloomington Area	Lee Rhodes	Donald W. Ferguson	Howard B. Elder
Capital	C. L. Ritchie	Gerald Margrave	Charles A. Marr, Sec.
Central Illinois	John Castle	Harlow Piper, 1st Earl Kimmell, 2nd Lee Sentman, 3rd	Ronald Knapp, Treas. Roger K. Snelson
Champaign	Warren S. Daniels	Daniel F. Hang, 1st Herbert W. Byers, 2nd	Ralph J. Henneman
Chicago	Gerald Marks	James G. Flood	Howard DePree
DuKane	Benjamin R. Houden	Walter Deuchler, Jr.	Paul F. Riddle
Egyptian	Maurice Webb	Fred A. Curl	John W. Weaver
Illinois Valley	Philip J. Faletto	Melvin S. Hook	Jerry E. Raffensperger
Joliet	James Gates	Sanger Westphal	Wayne S. Madden, Sec. Donald Larson, Treas.
Lake County	Emery Ikan	Frank J. Furlan	Art G. Hansen, Jr., Sec. Carl A. Anderson, Treas.
Madison County	Morgan B. Corlew	Ed N. Juneau	Ivan J. Lahay
North Shore	Sander Friedman	John L. Donoghue	Paul Steifel, Sec. Peter E. Haase, Treas.
N. W. Suburban	Wm. L. Berk	Joseph F. Koenan	Carl H. Bowen, Sec. Norman J. Toberman, Treas.
Peoriarea	Arthur E. Dini	Harold B. Ratcliff	Delwin E. Cobb, Sec. R. H. Harmeson, Treas.
Rockford	Roger K. Ericson	Clarence H. Wilson	Clifton E. Woest, Sec. Donald Rutan, Treas.
Rock River	L. B. Cappa	C. N. A. Richards	Ralph C. Davis
St. Clair	S. J. Petraitis	G. W. Kennedy	Leo Koberlein
Salt Creek	Wayne Reed	C. K. Creelman	Paul Flood, Sec. Richard Mitter, Treas.
Sauk Trail	R. A. Ekstrom	Sidney L. Zeid	Ivan J. Law, Sec. L. C. Baskin, Treas.
West Central	Kenneth H. Bowman	Richard S. Langman	B. Tom Staley
Western	John Treuthart	Richard C. Stegeman	Howard B. Brown

COMMITTEES 1960-1961

I.E.C. REPRESENTATIVES

DWAIN WALLACE, *Chairman*
ELLIS DANNER
J. D. VOORHEES
K. E. WELTON
R. H. RENWICK

ADMINISTRATIVE

Executive

L. D. Hudson, Chairman; H. S. Sommerschield, Manuel Garcia, C. Dale Greffe, John E. Housiaux, R. D. Collins, M. E. Amstutz, D. S. Magowan.

Awards

D. S. Magowan, Chairman

Nominating

M. E. Amstutz, Chairman

Operations Group

H. F. Sommerschield, Chairman
Membership—Charles Zanzie
Constitution & Bylaws—A. C. Kessell
Functional Sections—Roland Olson
Budget and Finance—H. F. Sommerschield
Chapter Activities—Francis Murray

STANDING

Professional Group

Manuel Garcia, Chairman
Education—A. L. Dierstein
Employment Practices—Carlos Hidalgo
Ethics & Practices—Robert Hamilton
Fees & Salaries—Wm. Blank
Legislation—H. A. Kluge
Young Engineers—W. S. Madden

Public Relations Group

C. Dale Greffe, Chairman
Building & Construction Codes—J. G. Goldenberg
Civil Defense—O. L. Meyers
Inter-Professional Relations—John Dolio
Publications—W. A. Johnson
Public Relations—W. J. Roberts
Resolutions—J. H. Morrow

Special

Policy Research—Dr. Allan R. Brown
Thomas Clark Shedd Memorial—Prof. William A. Oliver

The ILLINOIS ENGINEER is published monthly by the Illinois Society of Professional Engineers, Inc., at 714 Myers Building, Springfield, Illinois.

Second-Class postage paid at Springfield, Illinois.

Subscription rates are $2.00 per year in advance to members of the Illinois Society of Professional Engineers; $4.00 per year in advance to non-members in U.S.A. and its possessions, Canada, and Mexico. Foreign $6.00. Single copies 40c. Special issues $1.00.

"A MESSAGE FROM GARCIA"

The statement heard quite frequently during an election year, primarily quoted by the party out of office and anxious to get into office, is "It's time for a change!"

Many of the persons reading this article have probably just completed their annual vacation and while they were enjoying their vacations, either relaxing, or participating in their favorite sport, found that vacation time reflected "It's time for a change" and that the change of pace, of playing or relaxing as well as new suroundings at the vacation site, better prepares the individual for the ensuing year's work.

M. Garcia
I.S.P.E. Vice President

The expression "It's time for a change" is the subject matter for this article for it could very well apply to the engineer in industry who does not desire to affiliate or participate in professional activities outside his place of employment, viz., in Professional or Technical Engineering Societies; or, to an engineer in industry qualified for registration but reluctant to become registered in that he feels that it is not essential to his present employment.

This feeling, by many of the engineers in industry, of not wanting to affiliate with an Engineering Society and the reluctance to become registered, brings into focus that "It's Time For A Change" and we who are registered and who also belong to Professional and Technical Societies have a selling job to perform in bringing about such a change.

The growth and professional development of the engineer in industry should not be limited to the recognition given him by industry, although it is important that management knows him for his technical and professional ability, but, that the community, his neighbors, associates and friends should also know him and acknowledge the fact that he is a Professional Engineer. An engineer cannot carry a shingle of registration on his back indicating registration or professionalism (ethics does not permit this), but, recognition as a professional man is forthcoming as a result of the engineer's ability, actions, character, and attitude in his job as well as his participation in professional societies, civic, school and church affairs where his views and efforts reflect his training—this then brings about the desired recognition as a truly Professional Engineer.

Further evidence of the need for professional development of the engineer in industry can best be illustrated by the findings of a recent survey. This survey "Engineering Professionalism in Industry" was conducted by the Professional Engineers Conference Board for Industry in cooperation with N.S.P.E. A portion of its preliminary findings was printed in the July issue of the American Engineer Magazine.

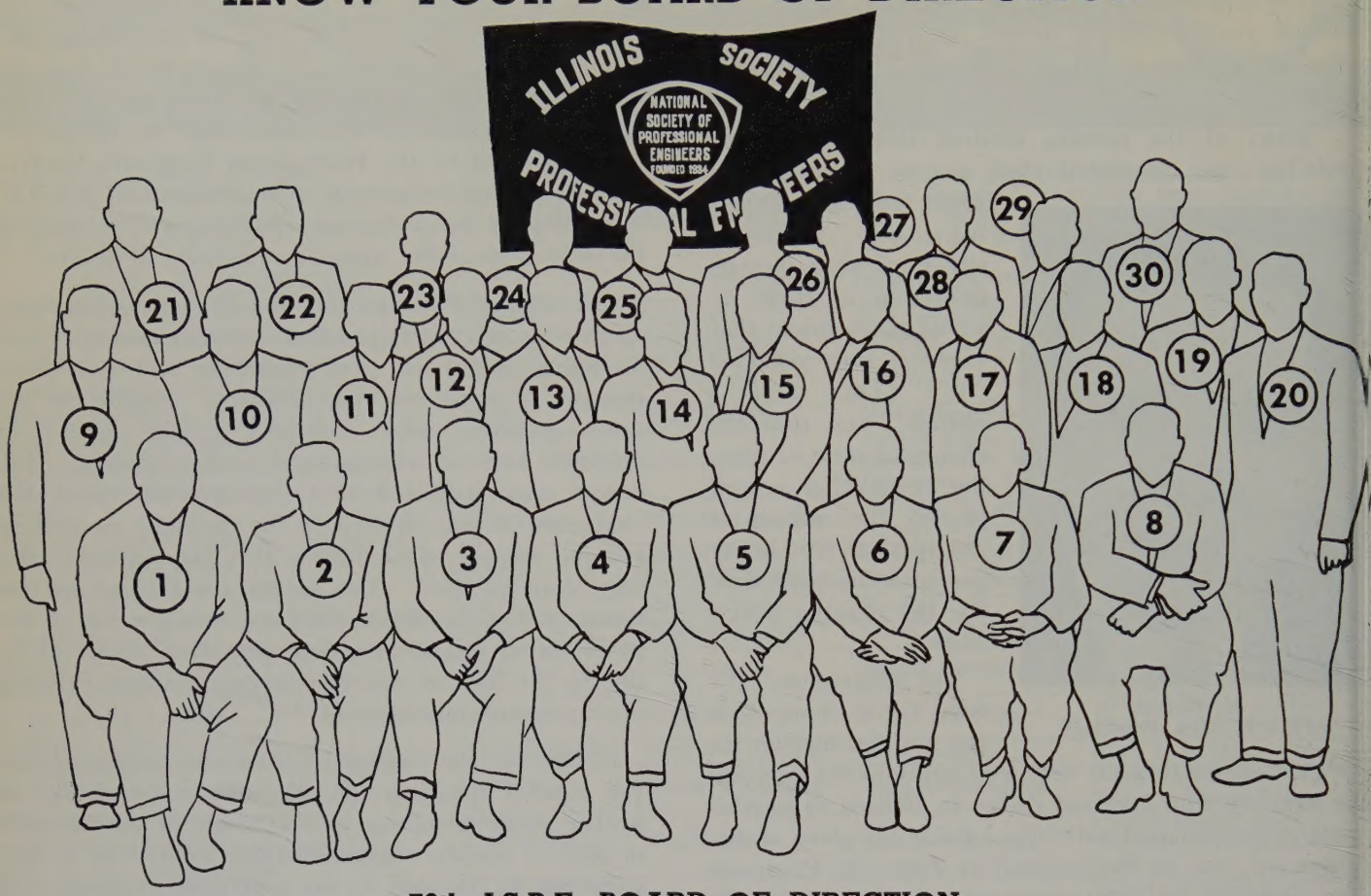
A total of 209 engineers and 40 engineering managers were interviewed to find out what engineers and managers meant by professionalism and how they thought it could best be advanced. Replies to the many questions asked indicated a wide spread in opinions between management and engineers. The report also indicated that management rated the engineers, in contribution to the company as well as genuine respect, much higher that the engineers felt they were so rated. The survey itself concluded, as stated in the American Engineer, "that a lot of the problems in engineering-professionalism seems to be due to the lack of two-way communications between engineers and management."

To me, the findings of the above-mentioned survey raise a question. Is the total responsibility of proper communications in the hands of management or should certain communications related to professionalism be initiated by the individual engineer? For proper two-way communications, it may be oversimplified by saying there has to be a transmitter as well as a receiver handled by each party involved in such communications. Therefore, both parties have the channels for communication and it is the responsibility of the engineer to use such channels of communication for advancing the professionalism of engineers in industry. The engineer must speak out by his actions and interests and he should initiate communications regarding these matters with management.

(Continued on Page 4)

CONTENTS OF THIS ISSUE

KNOW YOUR BOARD OF DIRECTION



76th I.S.P.E. BOARD OF DIRECTION

Front row, L. to R., 1. Robert J. Newbury, 2. John E. Housiaux, 3. C. Dale Greffe, 4. Harold F. Sommerschield, 5. LeVerne D. Hudson, 6. Manuel Garcia, 7. Melvin E. Amstutz, 8. D. S. Magowan.

Middle row, L. to R., 9. W. S. Gray, 10. Herbert Fox, 11. Ralph Frost, 12. Oscar L. Johnson, 13. Herbert L. Brantley, 14. Gilbert Henning, 15. Orville Evans, 16. Richard Thornton, 17. John T. Kearns, 18. J. Raymond Carroll, 19. Howard Verduin, 20. Anthony Zummer.

Back row, L. to R., 21. Arthur C. Kessell, 22. Thomas D. Gazda, 23. N. Y. Alvis, 24. W. K. Waltz, 25. G. Maurice Dixon, 26. Roy F. Trimble, 27. Joseph C. Ellis, 28. Ralph G. Michael, 29. Louis A. Bacon, 30. Benjamin R. Houden.

Absent from picture: R. D. Collins, F. W. Edwards, C. E. Missman, Dwain Wallace, M. Dean Wurth, Robert Geyer, Harry P. Watson, C. H. Sheppard, Edward F. Chelotti, W. D. O'Donnell, A. J. Feickert, John P. Dahlberg, Wm. H. Klingner, and Milton Shute.

1. ISPE's new Executive Director, **Robert J. Newbury,** began his work with the Society at the September 10 Board meeting. (See August issue for biographical data.)

2. **John E. Housiaux,** Central Illinois Chapter, became a member of the Board in 1957, the year following his term as Chapter President. He was elected ISPE Secretary in 1959 and re-elected for a two-year term in 1960. A mechanical engineer with Warren & Van Praag, Inc., of Decatur, John holds a BSME from the South Dakota School of Mines and a Master's degree from the U. of Colorado. He and his wife Phillis have two grade-school age children, a boy and a girl.

3. **C. Dale Greffe,** of Champaign County Chapter, a Professor of Mechanical Engineering at the University of Illinois, represented his chapter on the Board from 1955 until 1960 when he was appointed to fill a vice-presidential vacancy in the Society. He holds three degrees from the University of Illinois. He and his wife Veneta have two teen-age sons whose hobby, like their father's, is photography.

4. **Harold F. Sommerschield,** of Northwest Suburban Chapter, is 1st Vice President of ISPE. He has been a member of the Board continuously from 1951 except for 1955 when he served as Chicago Chapter President and 1959 as Special Assistant to the ISPE President. Hal is with Stanley Engineering Company, of Chicago. He and his wife Virginia have three children.

5. **LeVerne D. Hudson,** of Capital Chapter, is President of ISPE, having also served as 1st Vice President, as his Chapter President in 1951, and Chapter Representative since 1955. He is Regional Sanitary Engineer for the Illinois Department of Public Health and holds a BSCE degree from the University of Illinois and a Master's in Public Health Engineering from the University of Michigan. Verne's avocation is music; he plays trombone in the Springfield Symphony and is a member of the Shrine Band. He and his wife Eleanor have two teen-age daughters.

6. **Manuel Garcia,** of St. Clair Chapter, is now 2nd Vice President of ISPE. In 1959 he served as ISPE's 3rd Vice President. He has served his chapter as an officer since 1948, moving up to Chapter President in '56. Manuel is Assistant Chief Engineer for the Alton and Southern Railroad and lives in East St. Louis with his wife Betty Jean and their three daughters.

7. **Melvin E. Amstutz,** of Lake County Chapter, is a National Director and also serves on the Executive Committee as well as the Board of Direction. Mel first became a member of the Board in 1937 after serving his Chapter as President in 1935; he was ISPE Vice President in 1938 and President in 1939. He is a graduate of Northwestern University and is County Superintendent of Highways for Lake County. He and his wife Mary Leora live in Libertyville.

8. **D. S. Magowan,** immediate Past President of ISPE, is now a member of DuKane Chapter, but holds the distinction of having served as President of Chicago, Capital, and DuKane Chapters. He is District Engineer of the Illinois Division of Highways at Elgin. He and his wife Lorna have two sons and a daughter. "Mac" is an avid fisherman and doesn't let too many get away.

9. **W. S. Gray,** of Joliet Chapter, first became a member of the Board in 1953, after serving his chapter as Secretary-Treasurer in 1949, Vice President in 1950, and President in 1951. He served as ISPE National Director in 1959 and is now continuing in this capacity for a term which will expire in 1962. Bill received his Bachelor's degree from Armour Institute of Technology and is a supervisor in the Gas Accounting Department of The Peoples Gas Light & Coke Co., Chicago. He lends a hand to many civic committees and organizations and is presently a member of the Will County Board of School Trustees. He and his wife Barbara and two children live in Joliet.

10. **Herbert Fox** is an Alternate Chapter Representative for North Shore Chapter, having also served his chapter as Vice President in 1958 and as Chapter Representative in 1959. He is a graduate of the University of Illinois and is an engineer with the Cook County Highway Department. He and his wife June live in Chicago.

11. **Ralph Frost,** of Sauk Trail Chapter, first became a member of the Board in 1959. He received his degree from Illinois Institute of Technology and is employed as Director of Research, Airdox Cardox Products Company, in Chicago.

12. **Oscar L. Johnson,** of Peoriarea Chapter, began his first term this year as a member of the Board. He is a graduate of the University of Illinois and is employed as Field Engineer for the Caterpillar Tractor Company, East Peoria. He and his wife Ivabel live in Morton.

13. **Herbert L. Brantley,** of Capital Chapter, has served as Chapter Vice President ('57) and President ('58). He began his term as a member of the Board this year. Herb is a graduate of the University of Missouri and is Engineer of Aerial Surveys for the Illinois Division of Highways, Springfield. He and his wife Genevieve have two grown sons.

14. **Gilbert Hennings,** of Central Illinois Chapter, has been a member of the Board since 1958. He has also served his chapter as Vice President. Gil is an engineer with Warren & Van Praag, Inc. He and his wife Helen live in Decatur.

15. **Orville Evans,** of Illinois Valley Chapter, began his two-year term as a member of the Board this year. He received his BSCE degree from Rose Polytechnic Institute and is employed as Assistant District Right of Way Engineer with the Illinois Division of Highways at Ottawa.

16. **Richard Thornton,** of DuKane Chapter, became a member of the Board in 1958, after having served his chapter as Secretary-Treasurer in 1955 and as President in 1956. Dick is Chief Mechanical Engineer for the Aurora Pump Company.

17. **John T. Kearns,** of Champaign County Chapter, began a two-year term as Chapter Representative this year. He received his BSCE degree from the University of Notre Dame and is City Engineer for the City of Champaign.

18. **J. Raymond Carroll,** of Champaign County Chapter, served his chapter as Vice President ('57) and President ('58) before beginning a term on the Board in 1959. He received BSME and MSME degrees from the University of Illinois, where he is a Professor of Mechanical Engineering. Carroll is also an engineering consultant. He and his wife Darlene live in Urbana.

19. **Howard Verduin,** of Chicago Chapter was first a member of the Board last year as Chapter Representative. He is presently serving as Alternate Representative. Howard holds a BSME degree from Illinois Institute of Technology and is an associate in the firm of Nachman, Vragel & Associates. He and his wife Betty Jane live in Chicago.

20. **Anthony Zummer,** of Chicago Chapter, was a Board member in 1957 and again in 1960. He holds a BSME degree from Purdue University, an LL.B. degree from George Washington University Law School, and a degree as Master of Patent Law from the John Marshall Law School. Zummer has offices in Chicago and he and his wife Elizabeth reside in Chicago.

21. **Arthur Kessell,** of Capital Chapter, has been a chapter representative since 1956, but served first on the Board as an NSPE Alternate Director in 1952 and 1953. Art has been Treasurer, Vice President and Acting President of his chapter, in 1950 and 1951. He is Asst. Chief Mechanical Engineer of the Illinois Division of Architecture and Engineering, Springfield. He and his wife Margaret live in Springfield. They are the parents of two married daughters.

22. **Thomas D. Gazda,** of Rock River Chapter, is completing this year a two-year term as a member of the Board of Direction. He holds a BSCE degree from Purdue and is an associate with R. Hoffman & Associates, Dixon. He and his wife Beverly reside in Dixon. Tom is one of three members of his family who are members of ISPE, having two younger brothers who are Engineers-in-Training.

23. **N. Y. "Doc" Alvis,** of Ambraw Chapter, has been a member of the Board since 1958. He is Vice President of the Egyptian Concrete Pipe Company at Salem, and he and his wife Pauline live in Salem. They are the parents of a grown son.

24. **W. K. Waltz,** of Joliet Chapter, has served as Chapter Treasurer, Secretary, Vice President, and President, beginning a term on the Board in 1959 as chapter representative. He holds a BSEE degree from the University of Minnesota and is Signal Engineer for the Elgin, Joliet & Eastern Railway Company at Joliet.

25. **G. Maurice Dixon,** of Lake County Chapter, first became a member of the Board in 1943 and began a second term as chapter representative this year. He was Chapter Secretary-Treasurer from 1941 through 1943. Morrie is an engineer with the Lake County Highway Department, Waukegan, and lives in Gurnee.

26. **Roy F. Trimble,** an Alternate Chapter Representative of Bloomington Area Chapter, was elected to this position in 1960. He is the owner of Gray, Trimble Electric Company, Bloomington.

27. **Joseph C. Ellis,** is completing this year a two-year term as Chapter Representative of North Shore Chapter. Ellis holds a Bachelor's degree in Architectural Engineering from the University of Michigan and has done graduate work at Northwestern and New York Universities. He is a consulting engineer with offices in Evanston. He and his wife Mary live in Evanston.

28. **Ralph G. Michael,** of Salt Creek Chapter, began a two-year term as a member of the Board this year. He holds a BSCE degree from the University of Wisconsin and is Vice President and Chief Engineer for the W-M Corporation, Harvey. He and his wife Jean live in Hinsdale.

29. **Louis A. Bacon,** of Chicago Chapter, first served on the Board in 1959. He holds a BSCE degree from the University of Illinois and is an Associate Partner and Chief Structural Engineer with Shaw Metz & Associates, Chicago. He and his wife Clara live in Brookfield.

30. **Benjamin R. Houden** is serving as President and Alternate Chapter Representative of DuKane Chapter for 1960. He was chapter Vice President in 1959. He holds an AB degree from Cornell College and a BS degree from the University of Wisconsin. Houden is an assistant engineer with the Robert H. Anderson firm in St. Charles. Houden and his wife Dolores live in Elgin.

A Mission Accomplished

After trying during 1959 to get together two ISPE officials, a Chapter President, and a charter, on September 10, 1960, the mission was accomplished.

Shown above is John Housiaux, left, ISPE Secretary, looking on as D. S. Magowan, right, now Past State President, presents the Bloomington Area Charter to C. Lee Rhodes, Chapter President.

(Continued from Page 1)

Communications have been defined as "the art of letting others know what is going on," and I firmly believe that management is interested in the engineer and in his registration. In many cases management is instrumental in encouraging the engineer to register, in the development of his professional standing and his participation in other activities as hereinbefore mentioned.

In summary, the engineer in industry should strive for professionalism in the following manner: (1) If not already registered, registration should be the first step, (2) recognize the fact that management rates him high and essential to its operations, and (3) use the channels of communication (two-way communications) to gain a better understanding of the problems facing industry and also to let management know what is going on with respect to furthering professional development.

In order to reach these objectives of professionalism and in view of the lack of action in the past, we feel " IT IS TIME FOR A CHANGE."

NORTHWEST SUBURBAN CHAPTER HOLDS SECOND ANNUAL DINNER DANCE

Enthusiastic support of Northwest Suburban chapter was evidenced by the turnout of 69 couples for a truly gala evening at the chapter's second annual dinner dance held during this past summer.

After a satisfying dinner everyone relaxed to barbershop quartet melodies, laughed with M.C. Ted Gluck, P.E., and intently listened for their names to be called as a door prize winner. The dance combo then filled the hall with music, and the dancing continued until the wee hours.

BITUMINOUS PAVING CONFERENCE WILL BE HELD OCTOBER 18

A Conference on Bituminous Paving will be held at the University of Illinois Oct. 18.

Conducted by the U. of I. department of civil engineering and Division of University Extension, the conference will include talks by well-known engineers on "bituminous-treated bases," "black bases," and related subjects.

Prof. Moreland Herrin of the department of civil engineering is conference coordinator and Prof. R. K. Newton is supervisor of engineering extension, Division of University Extension. About 75 engineers are expected to attend.

Two I.S.P.E. National members have been assigned to new jobs with the Portland Cement Association, it has been announced by W. W. Wallace, district engineer, and a past president of I.S.P.E.

Jim Scott, a past president of DuKane Chapter, has been named general field engineer supervisor for Illinois. He was formerly quality concrete engineer.

Roland Olson, of Chicago Chapter, has been named as structural engineering supervisor for Illinois. Olson is presently State Chairman of the Functional Sections Committee and was 1959-60 chairman of the Functional Section for Registered Structural Engineers.

Mind Readers— We're Not!

We respectfully ask the cooperation of EVERY ILLINOIS SOCIETY MEMBER to please check his Roster Listing in the 1960 August issue of the Illinois Engineer. IS IT CORRECT?

If not, immediately upon receipt of this issue, please send us the exact way you wish your listing to read. We are in the process of converting our personnel records to I.B.M., and your cooperation will save much time and money if we have the correct information NOW.

For your convenience, a form for you to fill out and return to us is printed on page 22.

Thank you.

ROBERT J. NEWBURY
Executive Director

The following ten pages are new questions which have been used in a revised edition of the Professional Engineers Examination Book, published by the Illinois Society of Professional Engineers.

The entire 5th Edition of this publication is now available at the Society headquarters office.

Typical Questions

Taken from Examinations given by the State of Illinois Department of Registration and Education during 1957 and 1958.

Foreword

VERA M. BINKS
Director Department of Registration and Education
July, 1960

The Illinois Professional Engineering Act was passed in 1945, by the Illinois Legislature to protect the public from incompetence in the practice of professional engineering.

Since the effective date of the Act (July 20, 1945) the Illinois Professional Engineers' Examining Committee established by the Law, has devoted much time to study of examination questions and procedures, and has continued its cooperation with the Committees of the National Council of State Boards of Engineering Examiners, having to do with examinations.

It is not the policy of the Department to publish complete examinations. However, typical questions are released for publication from time to time, as included in this issue of typical questions. Part I (also used as the Engineer-in-Training examination) given on the first day, is comprised of two four (4) hour periods covering basic and engineering science. The questions are divided into principal subject groups. They embrace the subjects required of candidates for a baccalaureate degree of engineering by the College of Engineering of the University of Illinois, in accordance with the Act. Answers are required of at least one question in nearly all of the groups with additional questions selected optionally from all groups.

Part II of the examination, given on the second day, is comprised of two four (4) hour periods. It is professional in character, covers engineering practice, and serves to establish that the applicant is adequately qualified by engineering experience and knowledge, in accordance with the Act. Most questions are designed to test the examinees' knowledge of the application of principles to engineering practice largely in the broad general field of the various principal kinds of engineering. A number of questions are included in each of the several broad branches of engineering from which the examinee may select those to be answered. In addition a number of economics questions are included from which all examinees are required to answer a specified number.

Because Professional Engineer registration in Illinois is general and not by branches, questions do not necessarily cover engineering specialties which come under one of the broader branches of engineering. Some of the questions are intended to be of such a scope that they are suitable for engineers practicing in more than one category.

Signed: VERA M. BINKS
Director

FIRST DAY

1. A cubical block of wood 10 cm on a side and of density 0.5 gm/cm^3 floats in a container of water. Oil of density of 0.8 gm/cm^3 is poured on the water until the top of the oil layer is 4 cm below the top of the block. Fig. 1.
   (a) How deep is the oil layer?
   (b) What is the gauge pressure at the lower face of the block in dynes/cm^2?
2. Find the entire area between the curve $y = (1+X^2)^2$ and its asymptote.
3. A 9-ounce ball is thrown horizontally with a kinetic energy of 36 ft. lbs. from a vertical cliff 64 ft. high.
   (a) What is its kinetic energy when it strikes the ground, level with the bottom of the cliff?
   (b) What is the distance from the foot of the cliff at which it strikes the ground?
4. When air at atmospheric pressure is pumped into a tire its volume is compressed to 1/3 of its original value and the temperature rises from 60°F. to 100°F. What is the gage pressure of the air in the tire?
5. Two unequal size water pipes can jointly fill a certain cistern in 10-2/7 hours.
   The larger pipe will fill the cistern in 6 hours less time than the smaller pipe.
   How long will it take each pipe, operating separately, to fill it?
6. Cylinder A weighing 100 lbs. is placed in a box B, the bottom of which is inclined 30 degrees to the horizontal. Figure 2.
   The box is accelerated to the right at 20 ft. per sec. per sec.
   Determine the forces F_1 and F_2.
7. Two electrons are stationary when 1 cm. apart. They are allowed to move apart under the influence of their mutual repulsion.
   What is their relative velocity when they are 2 cm. apart?
   Charge of electron$=1.6\times10^{-19}$ coulombs$=4.8\times10^{-10}$ stat coulombs.
   Mass of electron$=9.11\times10^{-28}$ grams.
8. The current in a certain circuit varies with time according to the relation
   $$i = 4 + 2t^2$$
   where i is in amperes and t in seconds.
   (a) How many coulombs of charge pass a point in the time interval between $t = 5$ seconds and $t = 10$ seconds?
   (b) What constant current would transport the same
   (a) How many coulombs of charge pass a point in the circuit in the time interval between $t = 5$ seconds and $t = 1$ seconds?
   (b) What constant current would transport the same charge in the same time interval?

(c) What constant current would produce the same heating effect in the wire during the same interval?

9. Light is incident normally on the short face of a 30°-60°-90° glass prism. Figure 3.
A drop of liquid is placed on the hypotenuse of the prism.
If the index of refraction of the glass is 1.5, find the maximum index the liquid may have if the light is to be totally reflected.

10. An insulating wall has an area of 100 square feet and has a 4-inch air space which is to be filled with ground cork to improve its heat insulating quality. The thermal conductivity, k, for the cork is 0.30 Btu/(hr.)/(°F)/(ft.^{2})/(in.):
(a) Calculate the heat transfer per day for an inside temperature of 72°F. and an outside temperature of 10°F.
(b) How much can the heat loss be reduced by the installation of an additional one-inch sheet of insulating material of the same conductivity?

11. A drum 24 inches in diameter is used on a hoist which winds a cable under a tension of 500 lb. The drum is driven by an electric gear motor at a speed of 100 r.p.m. If the overall efficiency of the mechanism is 75 per cent and 746 watts equal one horsepower, determine:
(a) The horsepower output of the hoist.
(b) The energy cost at 2 cents per kilowatt-hour.

12. Calculate the theoretical yields of the following substances from 100 lb. of salt. (NaCl):
(a) Sodium and chlorine.
(b) Sodium hydroxide (NaOH) and hydrochloric acid.
Atomic weights may be taken approximately as Na = 23; Cl = 35; H = 1; 0 = 16.

13. In the frame shown in the sketch, determine the forces in the members AC and EC. Figure 4.
The plane ABCD is horizontal.

14. The cylinders shown have equal diameters, but cylinder 1 weights 800 lbs. and cylinder 2 weighs 1200 lbs. Solve for the reactions at A, B, C, and D, assuming all surfaces smooth. Figure 5.

15. (a) A mass of 40 pounds moving east at a velocity of 15 fps meets a mass of 20 pounds moving north at a velocity of 40 fps. Find the total momentum and the direction of the two bodies after the impact.
(b) A mass of 100 pounds is moving with a velocity of 40 fps and is brought to rest in 5 seconds. What is the deceleration?

16. A hollow steel shaft is designed to transmit 1000 hp at 1800 rpm.
If the outside diameter of the shaft is 3 inches, how large may the inside diameter be so as not to exceed a shearing stress of 10,000 lb/in^2?

17. A certain masonry wall has a 4 in. thick facing wall bonded to an 8 in thick concrete backing. On a day when the room temperature is 68°F. and the outside temperature is 12°F., the inner surface temperature of the concrete is 57°F. and the outer surface temperature of the brick is 19°F.
The thermal conductivity of the brick is 0.36 and the concrete 0.68 Btu/(hr.)/(Ft.)/(°F.)
Determine:
(a) The overall heat transfer coefficient.
(b) The convection coefficients of the vertical concrete and brick walls.

18. A barometer tube 88 cm long contains some air above the mercury. It gives a reading of 68 cm when upright. When the tube is tilted to an angle of 45°, the length of the mercury column becomes 80 cm.
What is the reading of an accurate barometer?

19. A certain 1000 kva, 60 cycle, 550 volt alternator when short-circuit required 30 amperes field current to give **line currents** of 320 amperes. The magnetization curve of the alternator showed that with 30 amperes field current, the generated voltage **between lines** was 165 volts.
What is the synchronous impedance per phase
(a) If the alternator is Y connected?
(b) If the alternator is $\triangle$ connected?

20. A Yellow Pine cantilever beam 6" x 8" in cross-section, extends 4 ft. beyond its support and carries a concentrated load of 1,200 lbs.
Ignore the weight of the beam and determine
(a) The maximum stress.
(b) The deflection of the end.
(c) Is the beam reasonably safe?

21. Three moles of nitrogen ($\gamma = 1.4$ $C_v = 4.6$ $\frac{\text{gm. cal.}}{\text{mole}}$)
are at atmospheric pressure and 20°C.
The gas is then heated at constant volume to 40°C.
It then undergoes adiabatic expansion and returns to 20C.
Finally it is compressed isothermally to its original state.
(a) Draw the P-V diagram for this cycle indicating the successive states $P_1V_1T_1$, $P_2V_2T_2$, $P_3V_3T_3$.
(b) Find PV & T of each state in terms of $P_1V_1T_1$.
(c) Find the joules of work done in adiabatic expansion.
What is the value of the initial volume V_1?

22. Calculate the three line currents and their phase angles. The loads are listed below. Figure 6.

Load	
A	1200 Watts 0.8 P.F.
B	1200 Watts 1.0 P.F.
C	½ H.P. motor 80% eff. at 0.6 P.F.

23. In a rocket motor fueled with butane, C_4H_{10}, how many kilograms of liquid oxygen should be provided with each kilogram of butane to provide for instantaneously complete combustion?
$$C_4H_{10} + 0_2 \longrightarrow CO_2 + H_2O$$
Atomic weights C = 12.0 H = 1.0 0 = 16.0

24. A body weighing 322 lb. is subject to an acceleration (in the positive direction of x) which is a linear decreasing function of the velocity. The body is stationary at x = 0 when t = 0 and the force acting on the body at this instant is 100 lb. The acceleration is zero when the velocity reaches 100 feet per second.
(a) Write a differential equation which expresses the above situation mathematically.
(b) Find the velocity at any time t.
(c) Find the value of x at any time t.

25. (a) A centrifugal pump used to circulate calcium chloride brine of specific gravity 1.2 against a total head of 32 ft. is delivering 275 gpm. If the pump is 67 per cent efficient, how many horse power are required?
(b) A municipal pumping plant has a maximum capacity of 48,000 gal. of water per minute, pumping it against a total head of 122 ft. The pumps are 62.1% efficient and the electric motors are 92.3% efficient. The plant is operating at full load for 4 hours per day, and under 60% load for the rest of the day. If the cost of power is 1.8 cents per kw-hr, compute the monthly power bill.

26. A manufacturing plant is supplied from a 3 phase transmission line having a capacity of 10,000 KVA. The present balanced load is 8000 KW at a lagging power factor to load the line to its KVA capacity. Induction motors operating at an average power factor of .85 lag and a

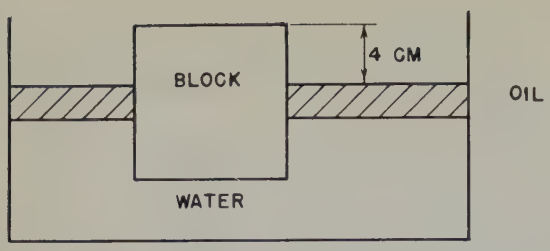


FIGURE 1.

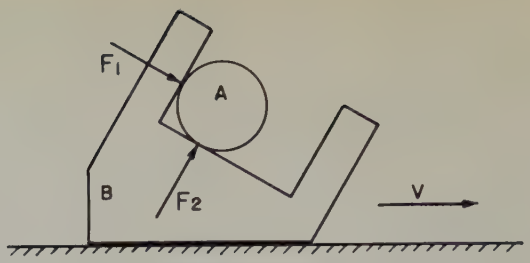


FIGURE 2.

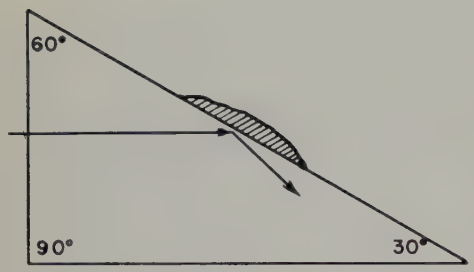


FIGURE 3.

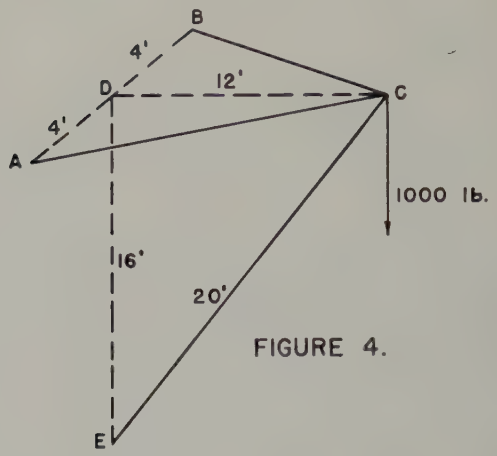


FIGURE 4.

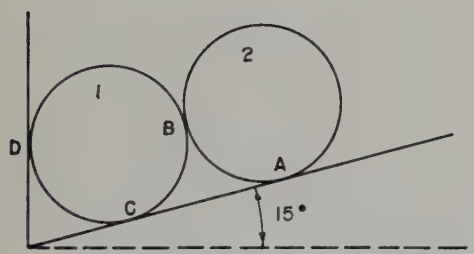


FIGURE 5.

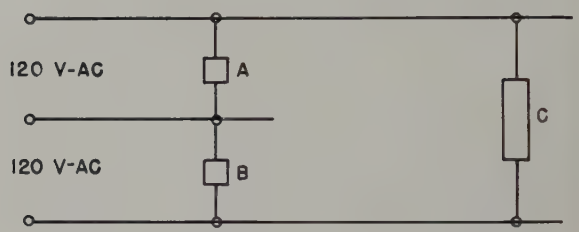


FIGURE 6.

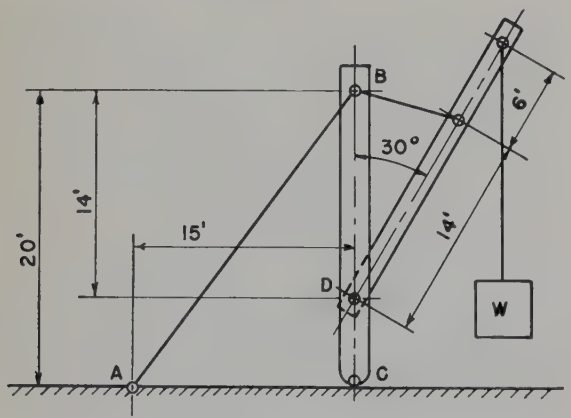


FIGURE 7.

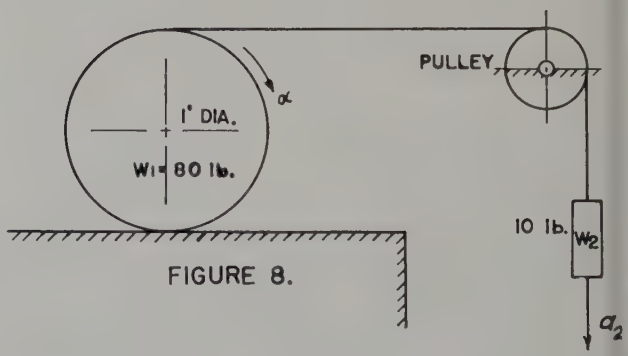


FIGURE 8.

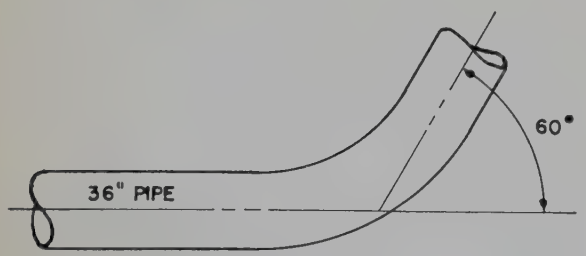


FIGURE 9.

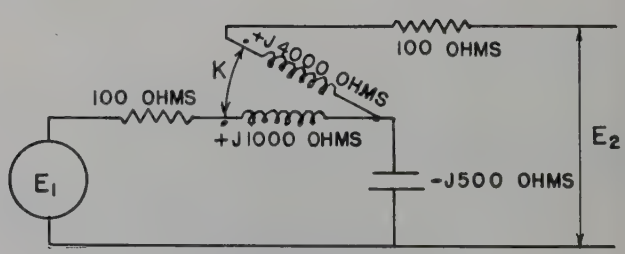


FIGURE 10.

synchronous condenser are to be added to the plant until the line is delivering its full KW capacity. The losses of the synchronous condenser are assumed to be 100 KW.

(a) Determine the maximum KVA in induction motors that can be added.

(b) What is the KVA rating of the condenser?

(c) Draw the power vector diagram.

27. Determine the tension in the rope AB and the shear on the pin D when the load W = 1000#. Figure 7.

28. A volume of gas having an initial entropy of 3000 Btu per °F. is heated at a constant temeperature of 1000F.° until the entropy is 4500 Btu per °F.

(a) How much heat is added?

(b) How much work expressed in Ft. Lbs. is done during the process?

29. Referring to the accompanying figure, a cylinder weighing 80 lb. is caused to roll on a horizontal plane by means of a cord passing over a weightless and frictionless pulley and attached to a weight of 10 lbs. Determine the acceleration of W_2 and the tension in the cord. Figure 8.

30. The heat of combustion of ethane gas, C_2H_6, is 373 kcal per mole. Assuming that 60% of the heat is useful, how many liters of ethane measured at 0°C and 760 mm Hg must be burned to supply heat enough to raise the temperature of 50 kg of water at 10°C to steam at 100°C?

31. (a) A 4-cylinder, 2-cycle engine has a 3.5 inch piston and a 4 inch stroke. What would be the mep required to develop 150 hp at 3000 rpm?

(b) If this engine takes air at 16 psia and 70°F temperature, and has a compression ration of 6.25 to 1, what would be the temperature of the compressed air? (Assume n = 1.3)

32. A horizontal 36-inch pipe curving through an angle of 60 degrees contains water with an average velocity of 7.1 fps and pressure of 50 psi. Find the force exerted on the bend by this discharge. Figure 9.

33. The circuit is that of an elementary audio-frequency meter. By changing the coefficient of coupling, K, in the variometer, the output voltage, E_2, may be reduced to zero, the condition of balance.

What must be the value of K in order that E_2 be zero when the frequency of the impressed voltage, E_1, is such as to yield the self-reactances indicated? Figure 10.

SECOND DAY

34. In this question you are requested to.

(1) (a) State your principal field of professional competence,

(b) Formulate a clear statement of an engineering problem occurring in your general field.

(2) **Outline** the major technical and economic factors involved in the solution of this problem in terms which can be understood by a professional engineer not a specialist in your field.

TIME LIMIT ONE HOUR

AS SOON AS YOU HAVE COMPLETED YOUR ANSWER TO THIS QUESTION TURN IT IN WITH THIS QUESTION SHEET AND OBTAIN THE NEXT SET OF QUESTIONS.

35. In the Beacon process for the manufacture of chlorine, a dry mixture of hydrochloric acid gas and air is passed over a heated catalyst which promotes oxidation of the acid. Air is used in 30% excess of that theoretically required.

(a) Calculate the weight of air supplied per pound of acid.

(b) Calculate the composition, by weight, of the gas entering the reaction chamber.

36. A 90 kva load consisting of 208 volt three-phase motors is supplied by a bank of three single-phase 2400/208 volt transformers. Load to be added will increase the total load to 150 kva. As no more 2400/208 volt transformers are available, a second bank of three single phase 2400/120 volt transformers is to be used for the required increase in capacity. The additional load cannot be split to place part of it independently on the first bank. Assume power factors of single and three-phase loads are the same. Transformer loads are not to exceed name plate ratings.

The problem is to be considered for each of the two following conditions.

(1) The transformers are supplied by a 2400 volt three-phase, three-wire circuit. The initial load is supplied by three 30 kva transformers. Capacity of the transformers for the second bank is to be 25 kva each.

(2) The transformers are supplied by a 2400/4160 volt three-phase, four-wire circuit. The initial load is supplied by three 37½ kva transformers. Capacity of the transformers for the second bank is to be 15 kva each. Primary phase voltages may be appreciably unbalanced.

Questions.

(a) Show, for conditions (1) and (2), how a second bank of transformers can be used to supply the additional load. Connection diagrams and vector diagrams may be used.

(b) State for conditions (1) and (2), the phase relalationship of the secondary line-to-line voltages of the two banks to each other.

(c) Point out for conditions (1) and (2), any precautions to be observed for satisfactory operation of the transformers.

(d) For condition (2), what is best practice with regard to operating with the bank primary neutral points closed to the circuit neutral vs. leaving them open or floating, and state why.

37. A cross drum inclined tube type water tube boiler is to operate at the following peak conditions:

Steam output 100,000 lbs. per hour.
Steam pressure, superheater outlet 425 lb. gauge.
Steam temperature, superheater outlet 700° F.
Temperature feedwater 200°F.
Efficiency of boiler, superheater, air heater and furnace 84.6%.
Furnace width between sidewalls 12 ft.
Heating value of coal 13,000 BTU per lb. If heat liberation is limited to 20,700 BTU per cu. ft. per hr., what furnace vol. is necessary?

38. Prepare 2 accurate legal descriptions of the shaded area shown in Fig. below, one being by metes and bounds, and compute the acreage therein. Figure 11.

39. A motor-driven centrifugal pump of 85% overall efficiency lifts 2000 GPM of water 50 ft. through an 8 in. diam. welded steel pipe having two 90 deg. elbows and one gate valve.

(a) Calculate the pressure loss in the piping;

(b) Calculate the horsepower required.

(c) What commercial size induction motor should be used to drive the pump?

40. When the three legs of a 3-conductor, lead-sheathed cable are connected together, the capacitance between the conductors and the sheath is found to be 0.45 mfd. When two of the legs are connected together and to the sheath, the capacitance between this combination

and the third leg is found to be 0.75 mfd. What is the value of the charging current in this cable when it is connected to a 3-phase, 33-kv system?

41. Water is to be pumped from one reservoir to another at the rate of 150 gallons per minute for an average of 12 hours per calendar day. The static head will be 50 feet and the force main will be 2000 feet in length. The force main will be cast iron pipe and will have a roughness coefficient of C = 100 (Williams-Hazen Formula).
    The basic data are as follows:
    (a) Both 4" pipe and 6" pipe are to be considered.
    (b) Pumps and motors will cost $2000 for a 6" force main and $2200 for a 4" force main.
    (c) The price per foot of force main installed will be $3.80 for 6" pipe and $3.00 for 4" pipe.
    (d) The annual maintenance cost of pumps and motors will be $160.00 per year using a 6" force main and $175.00 per year using a 4" force main.
    (e) The pumps and motors will have a rated efficiency of 60%.
    (f) Power will cost 2 cents per K.W.H.
    (g) Required useful life of the installation will be 20 years.
    (h) The rate of interest on the initial investment will be 5% per annum.
    Find the ultimate cost of each installation over a 20-year period, neglecting any salvage value which might remain at the end of 20 years.
42. Explain procedure for locating and developing an adequate and acceptable well supply for a small municipal water works.
43. It is required to construct a dike on original ground between two hillsides each having a slope of 1 ft. vertical on 3 ft. horizontal. Determine by average end area method the cu. yd. of material required to construct the dike with ground elevation as given at range lines listed below. The dike is to have a top width of 10 ft. at elevation 360.0 ft., with side slope of 1 ft. vertical on 3 ft. horizontal.

Range	Ground Elevation
0+00	360.0 ft.
0+69	337.0 ft.
1+69	338.0 ft.
2+69	340.0 ft.
3+69	344.0 ft.
4+69	342.0 ft.
5+23	360.0 ft.

44. A locomotive engine takes steam at 250 psia and 500°F. At release, $p_2 = 50$ psia, and at exhaust, $p_3 = 15$ psia. The steam consumption is 26 lb./(ihp) (hr.). Find the indicated thermal efficiency, and the combined engine efficiency.
45. You are the engineer to investigate a bridge site and to obtain field information for a basis of design of the structure. The river is wide and the banks on both sides are unobstructed. You are to take soundings of the riverbed on 100-foot grids for a distance of 1000 feet upstream and downstream from the proposed centerline of the structure. The river flows at a rate of about 5 miles per hour and has an average depth of 25 feet.
    (a) Describe in detail with sketch the methods and survey controls you would use to execute this assignment.
    (b) The designers require borings to rock at each of 5 piers within the river. The anticipated log is 1 to 3 feet of silt, 2 to 10 feet of soft clay, several feet of fine gravel and then bedrock. Describe with sketch how you would set up survey controls and the methods you would use to obtain the borings at **each** of the five pier locations.
46. Electric power is supplied to a distant load over a double circuit transmission line. The following data refer to the accompanying figure and are on a 40 MVA base. Resistances are considered negligible throughout. Figure 12.

System Element	Sequence Resistance Per Phase in Per Unit		
	X_1	X_2	X_0
Generator	0.20	0.10	0.05
Each Transformer Bank	0.05	Select	Select
Combination of two lines in parallel	0.25	Select	1.10

    (a) If the load is non-rotating, calculate the current in a line-to-ground fault at F making any necessary assumptions. Show impedance diagrams.
    (b) If the load is replaced by a synchronous machine of the same size and characteristics as the generator, would the fault current be
    doubled_____,
    more than doubled_____,
    equal to_____,
    or less than_____that calculated in (a)
47. Make a schematic drawing of a complete ammonia compressor refrigerating system for the refrigeration of a combined warehouse and freezing plant for frozen foods, locating correctly and designating by name all essential elements. Give a brief outline description.
48. A new manufacturing plant employing 5000 is almost completed. Electrical equipment ranges from 1000 HP drives to electronic automatic controls and instruments. Plan an organization responsible for maintenance, repair, modifications and minor development of this equipment.
    Discuss:
    (a) personnel in organization
    (b) duties and responsibilities of personnel
    (c) scope of organization
    (d) facilities—shops, labs, offices
    (e) training program
49. In order to minimize severe voltage disturbances the current drawn from a 440-V 3-phase industrial circuit is not to exceed 1500 amperes. A 3-phase induction motor to be operated from this circuit has a full load efficency of 0.85 and a power factor of 0.8. The starting current (locked rotor basis) is five (5) times rated full load current.
    (a) If the motor is to be started by connecting it directly across the line, what is its maximum permissible horsepower rating?
    (b) If pure series reactors are used to limit the starting voltage applied to the motor to 80% rated value, what is the maximum permissible rating of the motor?
    (c) If an autotransformer is employed to limit the applied starting voltage to 80% rated value what is the permissible rating of the motor? (Neglect impedance of the auto transformer).
50. (a) Find the drop in pressure in a 12 inch steam pipe (well-covered) 500 ft. long delivering 96,000 pounds of steam per hour at 150 pounds absolute pressure and containing 1 per cent moisture.
    (b) What horsepower is supplied to air moving at 20 ft. per minute through a 2 ft. by 3 ft. duct under a pressure of 3 in. water gauge?
51. A furnace wall consists of 13½" fire brick (k = 0.90 Btu/hr/ft./°F.), 4½" insulating refractory (k = 0.20)

and 8" common brick (k = 0.40) covered with a ¼" steel plate (k = 26.0). The temperature at the inner surface of the firebrick is 2250°F and at the outer face of the steel plate it is 140°F. Atmosphere 80°F.

(a) What is the heat loss in Btu/hr ft² of furnace wall?

(b) What is the value of the combined coefficient for connection and radiation from the outside wall?

(c) If the inside temperature is maintained what will be the surface temperature of the outside steel plate if the atmospheric temperature drops to 40°F.?

52. The chemical reaction equilibrium constant for the reaction

$$\frac{1}{2}N_2 + \frac{3}{2}H_2 = NH_3$$

is given as $\log_{10} K_f = \frac{4880}{T} - 5.883$

How much NH_3 would be formed from a mixture of 20 moles of N_2, 60 moles of H_2 and 20 moles of inert gas at a pressure of 400 atm and a temperature of 850°F., if the reaction time is sufficiently long to allow static equilibrium to be reached?

53. Transformers of various kinds find wide application in electrical engineering. In this question, answer the following questions relating to typical transformers for **either (1) audio frequency communications applications, or (2) electric power application.** If a particular question does not apply to the classification selected, so indicate, with brief explanation.

(a) Designate the classification selected and state briefly the principal function or functions of the type you have selected.

(b) Draw an equivalent circuit representative of the principal electrical features of the transformer, and which retains the identity of each winding.

(c) Draw at least two (2) approximately equivalent circuits which are suitable for appropriate load or frequency conditions. State such conditions.

(d) What special circumstances must be investigated if such transformers are operated in parallel?

(e) For what frequency ranges are such transformers commonly designed?

(f) Are thermal considerations a major or minor factor in the design, and if major, how is proper cooling accomplished?

54. Calculate the equilibrium percentage conversion of nitrogen to ammonia at 900°K and 250 atm, if the gas enters the converter with a composition of 75% hydrogen and 25% nitrogen. Do not assume ideal behavior.

55. Electrical power is supplied to a large load from two generating stations over a 138 kv. double-circuit transmission line. Each circuit has a zero sequence reactance of 1.4 per unit, and a positive sequence reactance of 0.5 per unit on a 100 Mva base. The zero sequence mutual reactance between lines is 0.4 per unit on the same base. Each generator and associated transformer bank has the following rectances on nameplate rating of 50 Mva. Figure 13.

Quantity	Generator	Gen. Tran. Bank
X_0	0.05 p.u.	select proper value
X_1	0.20 p.u.	0.10 p.u.
X_2	0.10 p.u.	select proper value

The receiving end transformer has 0.1 p.u. reactance on 100 Mva base. The generator transformers are connected delta star with the star on the line side and the neutral solidly grounded. The receiving end transformer is star delta connected with the neutral grounded through 0.3 per unit reactance.

(a) Show the sequence network connections and calculate the total current to ground for a ground fault at point F on the receiving end bus. All resistances are neglected in this problem. The effect of the load is also neglected here.

(b) If the load were replaced by a synchronous machine of 100 Mva rating, would the fault current be doubled_____ more than doubled_____ unchanged_____?

56. With the alignment information given in the Figure below, determine all curve data and compute deflection angles necessary to stake out curves, using railroad or highway curve tables and 25-ft. Chord lengths. Figure 14.

57. (a) A sheet pile cofferdam is being constructed in a lake and the base of the permanent structure will be 40 feet below the water surface. The character of the bottom of the lake is such that the uplift will be that of water only. The bottom of the cofferdam is to be sealed with concrete weighing 150 pounds per cubic foot without dewatering. What depth of concrete will be required to prevent the cofferdam from floating after dewatering?

(b) A pile was driven with a 3000 pound hammer with a free fall of 20 feet. If the pile sank 6 inches under the last five blows, what is its safe bearing value?

58. A pottery clay selling for $18/ton is mined and processed with a recovery of 85% at a process cost of $2/ton recovered. An improved process will increase recoveries to 95% but with additional expense and so the cost will be increased to $4/ton recovered. What new selling price would warrant installation of the improved process?

59. A rectifying column is to operate to separate a feed consisting of 50% methyl alcohol and 50% water (mole %) into a distillate having 90% methyl alcohol and a bottom having 90% water (mole %). The feed is liquid at the boiling point. The reflux ratio is 0.645. Equilibrium data for the methyl alcohol-water system at 1 atm are as follows:

Methyl Alcohol, mole %

Liquid	0	4.0	6.0	10.0	20.0	40	60	80	100
Vapor	0	23.0	30.4	41.8	57.9	72.9	82.5	91.5	100

Calculate the theoretical number of plates using the McCabe-Thiele method.

60. A series circuit of R, L and C is to resonate at $_{\omega}r = 10^6$ radians per second, have a band width between half-power points of $0.1_{\omega}r$ and draw 10 watts from a 100-volt source.

(a) Calculate the necessary values of R, L and C.

(b) What is the band width of this circuit, between quarter-power points, as a fraction of $_{\omega}r$?

61. To cut one tooth on a gear made of steel requires 10 seconds. There are 20 teeth around the circumference. It requires 25 seconds to load in fixture and 15 seconds to unload from fixture. The gear cutter operator classification is $2.00 per hour.

The indexing is automatic.

(a) Compute a decimal hour rate for cutting 100 gears. Allow 15% for PFD.

(b) In an 8 hour period the operator earned $21.50. How many gears did he cut? What per cent would you rate his performance?

(c) Two additional gear cutting machines are added for the same operator to operate. The same gear is cut on all 3 machines. 5% is allowed to move

between machines. Compute a decimal hour rate for cutting 100 gears.

(d) With a machine cost of $5.00 per hour, what is the proper number of machines for one operator to operate for the lowest cost for cutting a gear?

62. (a) A community of 2,000 persons, located 50 miles from any large city, has no public sanitary sewerage facilities. The community has a municipal waterworks system which is well constructed, in good condition, and free of debt. The water is pumped from wells and both the quality and quantity of the supply are adequate to serve the anticipated future demands of the community. The community is principally residential in character and appears to have only normal possibilities for residential, commercial, and industrial expansion.

An engineer is employed to prepare a preliminary report for a complete sanitary sewerage system, including sewage treatment works.

Prepare an outline showing the principal information and data required and the influencing factors which must be considered in the preparation of the preliminary report.

(b) Outline and explain eight or more of the most important factors which are normally considered by the engineer before recommending that a sewage treatment for a community of 5000 population be a trickling filter or an activated sludge type of plant.

Wherever possible, explain the factors in language understandable to the average group of laymen, such as a village board or city council.

63. A straight condensing steam turbine is supplied with steam at 250 psig and 550°F. It exhausts at a backpressure of 2 inches of Hg. abs. The steam rate is 15 lb/kw.hr.

Compute (a) the Rankine cycle efficiency
(b) the actual thermal efficiency

64. A bond has a face value of $5000, with interest at 5%. The interest is paid semi-annually and the term of the bond is 10 years. At the end of the fourth year with 6 years to go, the bond is to be put up for sale. The buyer of the bond wishes to earn the same rate as the bond, namely 5% semiannually. What is the total valuation of the bond at the end of the fourth year?

65. A steel water tank having a capacity of 220,000 gallons is to be erected in a residential area. For architectural reasons the tank will be masked by a masonry tower. The masonry tower will be 35 feet square and 80 feet above the top of its mat footing which will be level with the ground surface. The structure will be supported on steel piles which are to be arranged in a square pattern 4'-0" c. to c. in each direction, and there are to be eleven rows in each direction.

The estimated weights of the structure are:

Steel tank and supports.....1,400,000 lbs.
Masonry masking .....1,090,000 lbs.
Mat footing .....1,830,000 lbs.

Wind is presumed to act in any horizontal direction and to exert a pressure of 30 lbs. per sq. ft. on a surface normal to its direction. Pressure on a surface at an angle with the direction of the wind may be estimated from Duchemin's formula or other recognized rule.

Calculate the maximum pressure on a pile:

(a) Excluding wind.
(b) Including wind.

66. A linear Class A amplifier employs a high vacuum triode having an amplification factor of 8 and a plate resistance of 10,000 ohms. The load in the plate circuit consists of a resistor of 20,000 ohms and a capacitor of 0.02 microfarads connected in parallel. If the grid signal voltage is 3 volts r.m.s. at 800 cycles

(a) What is the complex voltage gain?

(b) What are the minimum quiescent plate current and minimum negative grid bias voltage values for Class A_1 operation?

67. Water is heated in a heat exchanger from 60 to 150°F. Calculate the pressure drop through the straight section of tubes in the heat exchanger if the water enters the tubes at a velocity of 5 ft/sec and the total length of straight tubes is 64 ft. The tubes are 0.902 inches I.D.

68. "A" Street is to be improved and paved. It is necessary to compute the length of vertical curve to meet the grade of "B" Street which is paved. Figure 15.

Compute length of vertical curve to the nearest 0.10 ft.

69. Calculate the reading of each wattmeter for the circuit shown in Fig. 16.

$V\,ab = 120\ \ 0$; $V\,bc = 120\ \ 120°$; $V\,ca = 120\ \ -120°$
$Z_1 = 8.66 + j5$; $Z_2 = 6 + j8$; $Z_3 = 5 + j5$

70. A certain set of crushing rolls has rolls 40 inches in diameter by 15 inches width of face. They are set so that the crushing surfaces are 0.5 inches apart at the narrowed point. The manufacturer recommends that they be run 50 to 100 rpm. They are to crush a rock of specific gravity 2.35 having an angle of nip equal to 30 degrees. What are the maximum permissible size of feed and the maximum actual capacity in tons/hr, if the actual capacity is 12% of the theoretical?

71. Two reservoirs are connected by 4000 feet of circular unlined tunnel through rock. The tunnel is 10 feet in diameter and the roughness coefficient applicable to Manning's formula is 0.040. The difference in elevation of the water surface in the reservoirs is 20 feet. If the rock tunnel is lined with concrete its diameter will be reduced to 9.5 feet and the roughness coefficient will be reduced to 0.015.

(a) Compute the flow through the tunnel in cfs under each condition.

(b) If the average thickness of the lining is 3 inches and the concrete can be placed for $200.00 per cubic yard, what would be the cost of lining the tunnel?

(c) If the water can be sold at the lower reservoir for $5.00 per acre-foot what would be the value of the increased flow per day after lining?

(d) If flow is at full capacity 300 days per year and the cost of lining the tunnel is to be amortized over a period of twenty years, with interest at 5% per annum, would lining the tunnel be economically justified?

Show computations.

72. A manufacturer offers an inventor the choice of two contracts for the exclusive right to manufacture and market the inventor's patented article. Plan A calls for an immediate single lump-sum payment of $30,000. Plan B calls for an annual payment of $1000 plus a royalty of 50 cents for each unit sold. The remaining life of the patent is 10 years.

Assuming interest compounded annually at 5%, what must be the uniform annual sale of the article to make plan B as attractive to the inventor as plan A? (Disregard income-tax considerations).

73. A 1-inch diameter steel wrist pin is made of SAE 1010 steel. The pin is surface carburized until the surface to a depth of 1/16 inch has been increased in carbon

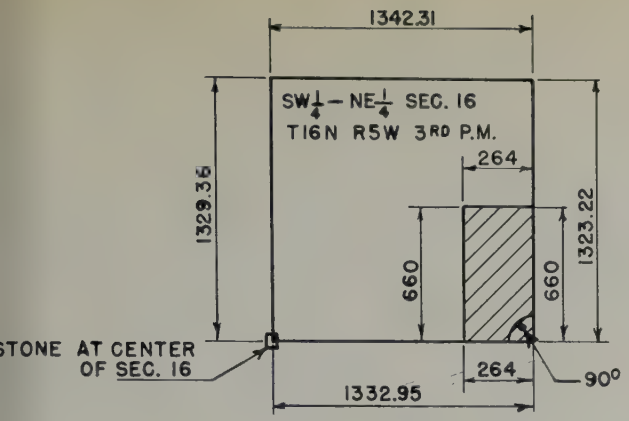


FIGURE 11.

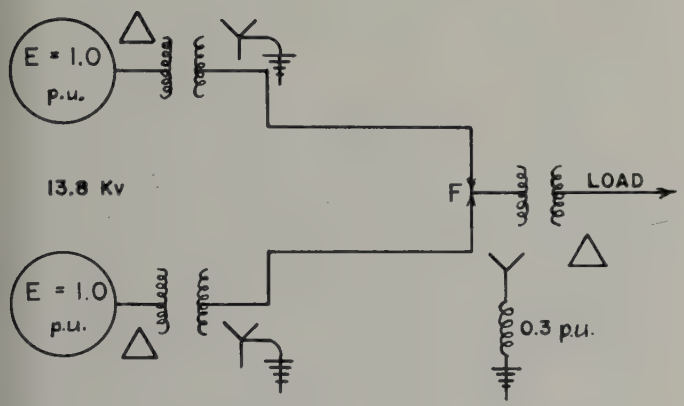
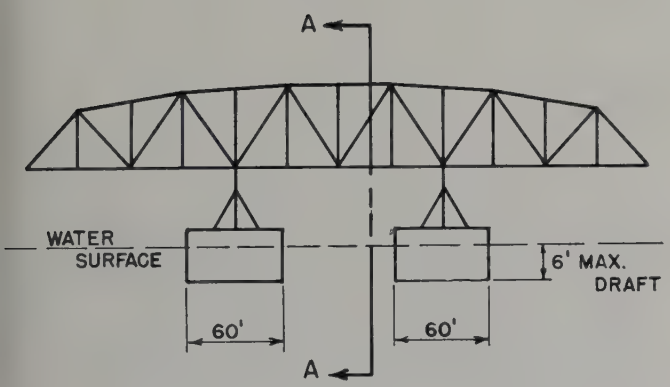


FIGURE 13.



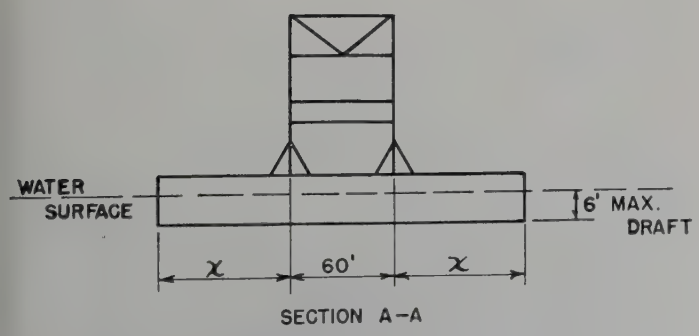


FIGURE 17.

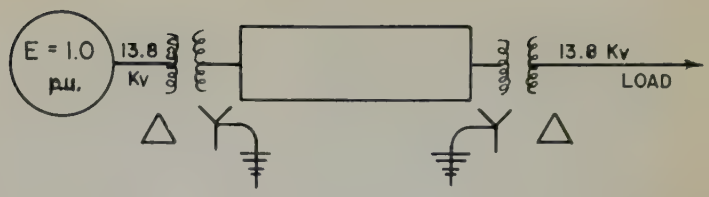


FIGURE 12.

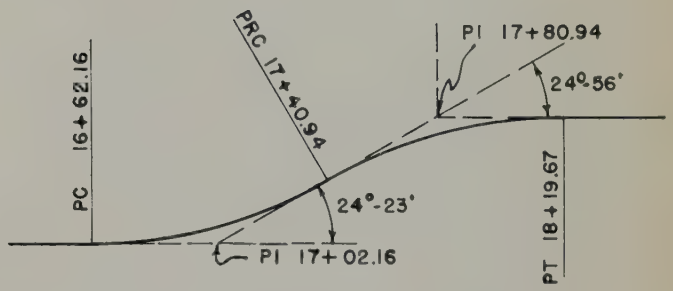
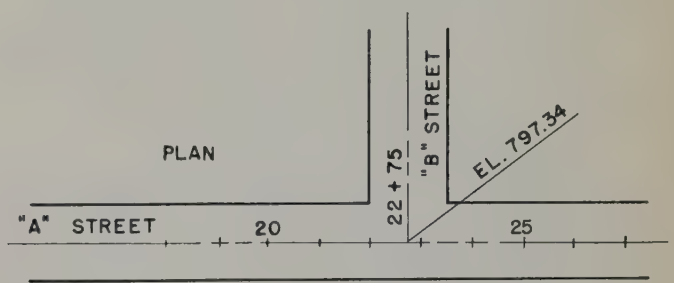


FIGURE 14.



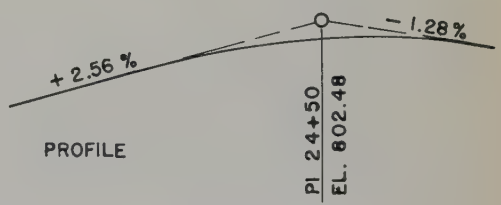


FIGURE 15.

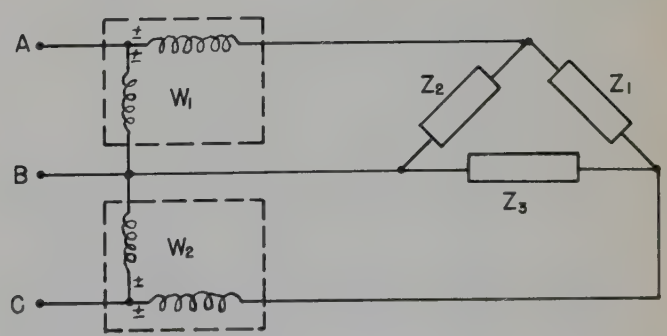


FIGURE 16.

content to 1.65%. These pins are to be heat treated to

(1) refine the surface grain structure.

(2) refine core grain structure.

(3) harden surface as much as possible.

Workman A heats the pin at 1400°F., air cools, reheats to 1700°F., and water quenches.

Workman B heats to 2100°F., furnace cools, reheats to 1400°F., water quenches.

Workman C heats to 1700°F., oil quenches, reheats to 1400°F., water quenches.

1. Which is correct and why?
2. What microconstituents are present in the case and core after each of the four operations by workman B.

74. The following data are available for the ammonia synthesis reaction:

$$\tfrac{1}{2}\ N_2\ (g) + 3/2\ H_2\ (g) \longrightarrow NH_3\ (g)$$

$\triangle H°\ (298°K) = -11{,}000$ cal/g-mole of ammonia

$\triangle S°\ (298°K) = -23.7$ cal/(°K) (g-mole of ammonia)

N_2: $C_p = 6.30 + 1.819 \times 10^{-3}T - 0.45 \times 10^{-6}T^2$

H^2: $C_p = 6.88 + 0.066 \times 10^{-3}T + 0.279 \times 10^{-6}T^2$

NH^3: $C_p = 5.92 + 8.963 \times 10^{-3}T - 1.764 \times 10^{-6}T^2$

where T is temperature in degrees Kelvin.

(a) Calculate the standard free-energy change and the equilibrium constant at 500°C.

(b) Estimate the value of K_p if the total pressure is 250 atm.

75. A six pole 20 H.P. 600 volt 60 cycle 3 phase Wye connected wound rotor induction motor has the following data all referred to the stator side and per phase.

$R_1 = .70$ $\quad X_1 = 2.0$ $\quad G_0 = 1.4 \times 10^{-3}$ mho

$R_2 = .85$ $\quad X_2 = 1.9$ $\quad B_0 = 2.1 \times 10^{-2}$ mho

(a) Draw the approximately equivalent circuit for a slip of 2%.

(b) Determine the stator current for a slip of 2%.

(c) Determine the primary power factor, the output, efficiency and torque at 2% slip.

(d) Calculate the starting torque and maximum torque for this motor.

(e) At what slip does the maximum torque occur?

76. Answer four of the following:

(a) Give **three** methods which may be used to keep fresh concrete moist when exposed to rapid-drying conditions.

(b) If a piledriver crew had a timber pile only partly driven at a quitting time, would you, as resident engineer, allow the crew to stop work and resume driving the next morning? Explain your decision.

(c) What are the advantages and the disadvantages of using mechanical internal vibrators in placing concrete?

(d) A new highway will have a 20-foot-deep embankment. Describe **three** methods of compacting the fill and explain how **each** method is used.

(e) For reinforced concrete made with Type I portland cement, placed and maintained at an average temperature of 60 F., give the time limit in days before you would remove the forms from the (1) floor slab, (2) beam sides, (3) girder bottoms, (4) long-span bridge arch centering.

77. The vapor pressures of n-pentane and n-hexane are given below. It may be assumed that Raoult's law applies to mixtures of these two substances.

Temp., °C	Vapor Pressure, atm. n-Pentane	n-Hexane	Temp., °C	Vapor Pressure, atm. n-Pentane	n-Hexane
17.5	0.500	0.138	43	1.355	0.460
20	0.552	0.154	48.5	1.49	0.500
25	0.665	0.195	55	1.79	0.631
30	0.802	0.242	60	2.08	0.750
36	1.00	0.316	65	2.41	0.875
40	1.13	0.362	69	2.70	1.00

Construct an xy-diagram for a total pressure of 1.0 atm.

78. A pentode, in which gm $= 1{,}000 \times 10^{-6}$ mho and rp $= 10^6$ ohms, drives a power triode the effective total input capacitance of which is 20×10^{-12} farad. The effective input conductance of this triode may be neglected. The coupling between the two tubes is by means of an R-C network in which the load resistance is 0.25 megohm, the coupling capacitor has the value of 0.005×10^{-6} farad and the grid resistor has the value of 1 megohm. Calculate (a) the gain of the pentode stage at the frequency of 5,000 cps and (b) the frequencies at which the response falls to the half-power values.

79. Prepare specifications for a boiler feed pump which is to be used with a boiler operating at 1450 pounds per square inch gage pressure and producing 500,000 pounds of steam per hour. Assuming that the pump is to be driven by a 3500 R.P.M. motor, sketch a longitudinal section of the pump indicating the diameters of the impellers and number of stages required. Establish an expected mechanical efficiency for the pump and calculate the horsepower requirements for the motor.

80. The Malden Central School District has under consideration two alternative plans for school construction. Plan A proposes the construction of a small building immediately and the construction of a second building of the same size at the end of 15 years. Each building will cost $1,000,000. Plan B proposes the construction of a larger building at a cost of $1,500,000, requiring no future capital expenditure.

The district proposes to finance the capital cost of each school by selling, at the time of construction, 30-year bonds bearing an interest rate of 3½% per annum. Debts are to be retired by uniform annual payments combining principal and interest. Depreciation of each structure is by straight line over 50 years with no salvage value at the end of that period. Maintenance cost per year in plan A is estimated at $20,000 per year per structure, and in plan B, $30,000 per year.

Compare the present worth of each plan.

81. In a small factory, the boiler room is separated from a production department by an 8″ brick wall 40 ft. long by 10 ft. high, plastered on one side, with one 2″ pine door 8 ft. wide by 8 ft. high. Temperature in the boiler room was 120 degrees F. and in the production department was 90 degrees F. To reduce the temperature from 90 degrees, another wall was erected on the production department side of the existing wall but nothing was done to the door. The new wall was made of 8″ of cinder block with a 2″ air space between walls. Assuming outer air temperature was 70 degrees F. and that heat losses from the room were proportional to the temperature difference between inside and out, what would be the new temperature in the production department?

82. A triode with an amplification factor of 20 and a plate resistance of 10,000 ohms is used as a linear class A_1 amplifier with resistance capacitance coupling. If the grid resistor of the succeeding stage is limited to 10^6 ohms, what values of load resistance RL and coupling capacitance Cc will give voltage gain of 15 in the middle range of frequencies and a lower half-power frequency of 30 c.p.s.?

83. If a mixture of liquid oxygen and nitrogen containing 95 mole per cent oxygen by volume were subjected to simple distillation at a constant total pressure at 1 atm, what percentage by weight of the liquid would have to be distilled to enrich the residue to 98 per cent oxygen? (Assume Raoult's law holds for these two components. The ratio of the vapor pressure of pure oxygen to

that of pure nitrogen at the normal boiling point of oxygen is 0.280.)

84. In the form milling of S.A.E. 4047 steel with a high speed steel, 2.00-inch mean diameter cutter with 8 teeth, the recommended cutting speed is 40 ft. per min., and feed is .002 inches per tooth.
    (a) Calculate the rpm of the cutter.
    (b) Calculate the feed in inches per min.
    (c) An ordinary turret lathe can produce 11 pieces per hour. A vertical multi-matic can produce 81 pieces per hour. The cost per hour of running the vertical lathe is 6 times the cost of the other lathe. What is the comparative cost per piece for running the job on the two lathes?
    (d) A milling cutter is 5¼ inches in diameter. The steel being milled can be worked best at a surface speed of 100 ft./min. The rpm table on the machine contains the following values: 52, 60, 72, 80, 92. Select the nearest usable speed. What per cent of the best working speed is the selected speed?

85. A highway bridge truss span, having a length of 420 feet and a width of 60 feet center to center of trusses, is to be floated into position on two barges placed under the third points of the span as shown in the figure. Each barge is to be 60 feet wide and for the purposes of this problem is assumed to have square ends. The weight of each barge, fully equipped, is 4800 lbs. per foot of length and this weight may be assumed to be uniformly distributed along the length. Figure 17.
    Given that the draft is not to exceed 6 feet and that water weighs 62.4 lbs. per cu. ft.:
    (a) Determine the lengths x.
    (b) Draw the shear and moment diagrams for one barge as a whole, show the magnitudes of the shears and moments and be careful to show correct shapes of the diagrams. The weight of the bridge is to be assumed as distributed uniformly across the width of the barges on the lines of support.

86. (a) Two distribution transformers rated 25 Kva 2400-240/120 volts 60 cps are available for supplying the lighting service to a building. One transformer has an impedance of $3 + j4$ per cent while the other has an impedance of $4 + j3$ per cent. What is the maximum unity pf load in kilowatts which can be supplied by the two transformers in parallel without exceeding the name plate rating of either transformer?
    (b) If one of the transformers of part (a) has windings rated 2280-240/120 volts, and the transformers are operated in parallel at 2400 volts, determine the total loss of the combination at *no load* if the combined core loss is taken as 1000 watts.

87. Data for a certain airplane: Weight=50,000 lb., wing area=1500 ft², wing span=120 ft., parasite drag coefficient=0.020, e=0.833, constant power available=10,000 H.P. Find maximum rate of climb at sea level and at what velocity it occurs.

88. Design a welded base connection for a 14 WF 228 column carrying an axial load of 1000 Kip. The allowable bearing on the concrete is 1000 psi. Detail all welding using appropriate A.W.S. Standard Welding Symbols.

89. A standard pumping installation costs $15,000 installed and has an estimated life of 12 years. By the addition of certain auxiliary equipment, an annual saving of $200 in operating cost can be obtained and the estimated life of the installation can be doubled. Neglecting any salvage value for either installation and with interest at 6%, what present expenditure is justified for the auxiliary equipment?

90. Condensing steam (saturated at 115 psia) is used on the shell side of a shell-and-tube heat exchanger to heat 1500 pounds per hour of an aqueous solution (Cp = 0.92 Btu/lb°F.) from 60°F. to 180°F. Assume that the heat exchanger is adequately insulated. How much steam is required if the condensate entrains 0.05 pounds of steam per pound of water? Compute the "lost work" in Btu/hr and horsepower.

91. (a) D-C generators whose service requirements demand operation over a wide range of adjustable voltages are usually separately excited rather than self-excited. Why?
    (b) The steady-state current of a shunt generator feeding into a short circuit is frequently lower than the normal full-load current. Explain briefly.
    (c) How would you convert an over-compounded generator into a flat-compounded generator?
    (d) The speed of a flat-compounded self-excited generator operating at no load is decreased by 10 per cent. No other changes are made. Will the change in terminal voltage be equal to, more than, or less than 10 per cent?

92. Two reservoirs at different elevations are to be connected by 30,000 feet of C.I. pipe and water is to be pumped from the lower to the upper reservoir. The difference in elevation between the pump discharge and the pipe spilling into the upper reservoir is 195 feet. The maximum allowable pressure in the pipe is 150 p.s.i.
    If C = 130 (Hazen-Williams Formula), at what rate can water be pumped through
    A 6-inch pipe?
    An 8-inch pipe?
    A 10-inch pipe?
    A 12-inch pipe?
    If the overall efficiency of the pump and motor assembly were 70%, what would be the rate of power consumption in kilowatts in each case?

93. A pump having a capacity of 1390 G.P.M. against a 50 foot total head was purchased and installed in a well without engineering advice and, after 12 months operation, it appeared that power costs were unusually high. An Engineer was employed to investigate the matter and found that the pump was operating at only 60% overall efficiency. A new pump of the same capacity but with 70% overall efficiency could be purchased and installed for a price difference of $3,500.00. The additional annual depreciation on the new pump would be $175.00.
    The pump will operate 12 hours per day and power is being purchased under a long term contract for 2 cents per K.W.H.
    Show by computations whether or not it would be cheaper to purchase and install the new pump. Neglect interest costs, maintenance and depreciation on the old pump during the 12 months it has been in use.

94. A metal smelting company is considering the possibility of making Admiralty Metal by melting together suitable quantities of scrap Wrought Bronze and scrap Cartridge Brass. The composition of these alloys, all in weight percent is tabulated below. Is the suggestion sound? If so, in what proportion should the two kinds of scrap metal be mixed?

	Admiralty	Wrought Bronze	Cartridge Brass
Copper	71	90	70
Zinc	28	..	30
Tin	1	10	..

VERNON M. ROMINE

Vernon M. Romine, Engineer of Bridge and Traffic Structures, Illinois Division of Highways, died on Sunday, July 10, after an illness of some five months. He is survived by his wife, Edith, his daughter, Beverly Jeanne Wright, a granddaughter, two brothers and two sisters, and his father.

Mr. Romine received his B.S. in Civil Engineering from the University of Illinois; and on June 16, 1925, reported to the Bureau of Bridges as a Junior Highway Engineer, Grade V. He served with the U. S. Army Engineers in Iceland during World War II and was discharged as a Major in 1945. Returning to the Bridge Office he soon was appointed Shop Plan and Inspection Engineer, and on November 16, 1954, was appointed Engineer of Bridge and Traffic Structures.

Vern was a Registered Structural Engineer, Professional Engineer and Land Surveyor; and was a member of NSPE, Capital Chapter, ISPE, and Springfield Chapter, IAHE. He belonged to Tuscola Lodge No. 332, A. F. and A. M., Springfield Consistory, Ansar Shrine and the Royal Order of Jesters, Springfield Court No. 20. He was Captain of the Ansar Patrol for almost 10 years.

Always friendly and unpretentious, Vern was extremely popular and well known to members of ISPE and the engineering profession in general.

Robert "Rob" M. Roy, long-time member of DuKane Chapter of I.S.P.E., died on July 26, 1960. He had served as Chapter Representative in 1951-52 and attended many conventions of the Society. He was a special representative of Warren Bros. Roads Co., of Cambridge, Mass., and lived in Aurora with his wife. DuKane Chapter and the State Society have lost a valued member.

SPERRY ENGINEERS REJECT UNION

Paul H. Robbins, executive director of the National Society of Professional Engineers, has termed the rejection of the Engineers Association, I.U.E., AFL-CIO, by engineering personnel at Sperry Gyroscope Company as "welcome confirmation of the trend among engineers to look toward professional means to serve their interests."

A recent balloting by the engineers at Sperry resulted in 1,724 votes against the union, and 1,509 for the union.

Robbins said that "management, now relieved of restraints imposed by union representation and contracts, has the opportunity to institute new policies and programs which will meet the legitimate aspirations of engineering employees."

The executive director of the 52,000-member engineering group emphasized that the National Society's program "has always stressed the joint and mutual responsibility of engineers and management in the field of professional employment practices."

He added that the National Society, through its Engineers-in-Industry Committee, and the Society as a whole will do all it can to assist the engineers and the company in making the vote truly meaningful in terms of future advancement through professional concepts.

ELECTION TIME APPROACHES

The I.S.P.E. Nominating Committee, chaired by Past President M. E. Amstutz, is now working on its report, which will be published in the November issue of the *Illinois Engineer*. The Committee will welcome receiving suggestions or recommendations from Society members and Chapters. Following are instructions which Secretary Housiaux has sent to the Committee:

I.S.P.E. NOMINATION AND ELECTION SCHEDULE FOR 1961

1. President—1 year term beginning 21 April 1961
2. Vice President—1 year term beginning 21 April 1961
3. Vice President—1 year term beginning 21 April 1961
4. Vice President—1 year term beginning 21 April 1961
5. Treasurer—2 year term beginning 21 April 1961
6. National Director—3 year term beginning 21 April 1961
7. I.E.C. Representative—3 year term beginning 1 January 1962

NOTE: 1. Alternate National Director appointed by the Board.

2. Chairman of I.E.C. Representatives (After expiration of D. M. Wallace's term, 1 January 1960 to 31 December 1962) appointed for 1 year by the President, subject to approval of the Board.

I.S.P.E. OFFICERS TO BE NOMINATED FOR 1961 ELECTION

1. 21 October 1960—Nominating Committee files its report with the Secretary
2. 21 November 1960—Publish report of the Nominating Committee in the *Illinois Engineer*
3. 21 December 1960—Final date for filing nominations by petition
4. 21 January 1961—Final date for mailing letter ballots to all corporate members*
5. 27 February 1961—12:00 Noon Polls Close
6. 27 February 1961—Counting of ballots by Tellers Committee
7. 21 March 1961—Publish results of election in the *Illinois Engineer*
8. 21 April 1961—Annual Meeting—All duly elected officers assume the duties of the office to which they have been elected and for the length of term as stated on the ballot. (Except I.E.C. Representatives).
9. 1 January 1962—Newly elected I.S.P.E. representative to I.E.C. assumes office as of 1 January 1962, the beginning of the I.E.C. administrative year.

* NOTE: Bylaws require that: "Provisions shall be made on the ballot for write-in candidates for each office to be filled."

I.S.P.E. MEMBERS:

Your State Society urges you to take advantage of monthly newsletters published by N.S.P.E.

In furtherance of the doctrine that individual opportunity for development is based upon a program of service to Society and the Profession as stated in the Preamble of the Constitution, your National Society publishes a series of newsletters—each of which is particularly designed to meet a specific need of engineers from different categories.

Members of the Society in good standing may receive any of them by requesting National headquarters to place their name on the mailing list for any particular newsletter. The newsletters are sent regularly only upon requests received individually from each member because they are intended to fill the particular needs of engineers in different categories of the profession.

1. *Legislative Bulletin* — Published monthly to keep professional engineers informed on current developments of interest to and affecting the engineering profession in national legislation, Administrative rulings and decisions. The Bulletin reports on NSPE activities with respect to legislation that affects the engineering profession.
2. *Private Practice News*—This monthly newsletter reports on significant developments of special interest to consulting engineers. The bulletin covers court decisions, legislation, Administrative rulings, NSPE Board action, new publications and studies and news from local sections of functional sections for engineers in private practice.
3. *Engineering Employment Practices Newsletter* — This monthly newsletter is intended to foster a spirit of cooperation and provide an interchange of ideas between professional engineers and their employers. The bulletin reports current items of interest on such topics as court decisions, new publications, studies and surveys dealing with problems of employed engineers, news of company practices and policies affecting employed engineers, salary data, efforts at unionization and

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS
2029 K Street, N.W., Washington 6, D.C.

At a member of the National Society of Professional Engineers, I would like to be placed on the mailing list to receive the newsletters checked below:

MONTHLY NEWSLETTERS

- ☐ Private Practice News
- ☐ Engineering Employment Practices Newsletter
- ☐ Legislative Bulletin
- ☐ Engineers-in-Government Newsletter

(Please print or type)

Name_____

Address_____

City_____ Zone____ State_____

the decisions and announcements of governmental agencies.

4. *Engineers-in-Government Newsletter* — This monthly newsletter is intended specifically to serve engineers employed by government—including Federal, state, city, county, authorities, administrations and boards. The bulletin carries current information of interest to all engineers employed by governmental agencies such as legislation, Administrative rulings and decisions, court decisions, salary data, studies and surveys of interest to engineers employed by governmental agencies of any type. The bulletin is sponsored by the Functional Section for Engineers in Government Practice.

Dean C. Merchant, son of Mr. and Mrs. Charles H. Merchant, 2433 South Glenwood Avenue, Springfield, Illinois, has been appointed Assistant Professor of Photogrametric Engineering at Syracuse University, Syracuse, New York. He commenced teaching on September 13.

During the past six years, Mr. Merchant has worked as research engineer on photogrametry and instrument development for the Fairchild Aviation Corporation at Long Island, New York. He received his master's degree in this field from Ohio State University in 1954.

C. H. Merchant is a member of Capital Chapter of I.S.P.E.

CONCRETE SEWER PIPE SEMINARS SCHEDULED FOR NOVEMBER

A seminar on Concrete Sewer Pipe will be conducted by The American Concrete Pipe Association and the Portland Cement Association for engineers in Illinois and the St. Louis area. Of particular interest will be the latest developments in rubber gasket pipe, quality control in the manufacture of concrete pipe, results of research completed by the University of Minnesota on energy losses at pipe junctions (use of T's and Y's in pipe lines) and recommended practice on curved pipe lines. Fundamentals will be briefly reviewed including design, specifications, loads, leakage limits, testing and installation. Sewer pipe engineering reference material will be distributed at the meetings.

Identical programs are scheduled to start at 2:00 P.M. at the following locations:

Nov. 9—Peoria—Vanochim's Junction
Nov. 10—Chicago—Graemere Hotel
Nov. 15—St. Louis—Statler Hotel
Nov. 16—Springfield—St. Nicholas Hotel
Nov. 17—Carbondale—Jackson Pk. Country Club
Nov. 22—Champaign—Champaign Country Club

These meetings are sponsored by the members of the Illinois Concrete Pipe Association. Engineers wishing to make reservations may write to The Illinois Concrete Pipe Association, 221 North LaSalle Street, Chicago 1, Illinois.

To: ILLINOIS SOCIETY OF PROFESSIONAL ENGINEERS
714 Myers Building
Springfield, Illinois

Name: _____ Wife's Name: _____

Grade of membership and year elected: _____

Business Title: _____ Business: _____

Business Address: _____ Business Phone: _____

Residence Address: _____ Residence Phone: _____

Colleges and Universities Attended: _____

Degrees and Years Obtained: _____

Society, organization and club memberships: _____

Registration (type of certificates—States issued): _____

Elective office in ISPE and year held: _____

Chapter affiliation: _____

PROFESSIONAL DIRECTORY

INDEX OF ADVERTISERS

PROFESSIONAL DIRECTORY

ALVORD, BURDICK & HOWSON

Water Works • Water Purification • Flood Relief
Sewerage • Sewage Disposal • Drainage • Appraisals
Power Generation

20 North Wacker Drive — CHICAGO 6, ILLINOIS

AUSTIN ENGINEERING COMPANY

Consulting Engineers

115 S. Jefferson Ave. — Peoria, Ill.

Phone 6-6360

Airports
Light and Power
Pavements
Sewerage
Waterworks

BELING ENGINEERING CONSULTANTS

DESIGNERS OF

Heating, Air Conditioning, Plumbing & Electrical Systems for Buildings • Water & Sewer Systems & Plants • Municipal Engineers, Subdivision Planners

307 - 16th St., Moline, Ill.

807 S. Neil St., Champaign, Ill. — 1011 Main St., Peoria 5, Ill.
10 Third Ave., Joliet, Ill. — 914 Grand Ave., Des Moines 9, Ia.
306 Park Ave., Rockford, Ill. — 314 N. 4th St., Burlington, Ia.

HOMER L. CHASTAIN & ASSOCIATES

CONSULTING ENGINEERS

Civil, Structural, Mechanical, Industrial Design and Supervision, Construction, Engineering, Turnpikes, Bridges, Water Supply, Sewerage, Flood Control and Drainage, Material Controls, Municipal Engineering, Topographic Surveys.

155½ West Main Street — Decatur, Illinois

CLARK, DAILY and DIETZ

Consulting Engineers

Sewerage, Waterworks, Street Lighting, Highways, Swimming Pools, Surveying and Mapping, Land Development Studies, Bridges, Buildings, Foundations

211 North Race St. — Urbana, Illinois

188 Jefferson St. — Memphis, Tennessee

CONSOER, TOWNSEND AND ASSOCIATES

Water Supply, Sewerage, Flood Control & Drainage, Bridges, Express Highways, Paving, Power Plant, Appraisals, Reports, Traffic Studies, Airports, Gas & Electric Transmission Lines.

SUperior 7-7054

360 East Grand Avenue — CHICAGO 11, ILLINOIS

HARRY H. CORDES

CONSULTING ENGINEERS

Registered Structural and Professional Engineers and Land Surveyors

2415 Charles Street — Rockford, Illinois

CRAWFORD, MURPHY & TILLY

CONSULTING ENGINEERS

Water Works, Sewerage, Airports, Street Improvements, Traffic Surveys

PHONE 8-5619

755 South Grand Avenue, West — SPRINGFIELD, ILLINOIS

CRESCENT ENGINEERING COMPANY, INC.

Contracting and Consulting Electrical Engineers
Design, Supervision and Construction
Process Power and Lighting for Industrial Plants

6455 South Central Avenue — CHICAGO 38, ILLINOIS

CHARLES N. DEBES ASSOCIATES, INC.

ENGINEERS AND ARCHITECTS

STRUCTURAL - MECHANICAL - ELECTRICAL
ACOUSTICAL - INDUSTRIAL - COMMERCIAL
AND MUNICIPAL PROJECTS

915 East State Street — ROCKFORD, ILLINOIS

DE LEUW, CATHER & COMPANY

CONSULTING ENGINEERS

Public Transit - Traffic & Parking - Expressways - Grade Separations - Urban Renewal - Subways - Railroad Facilities
Industrial Plants - Municipal Works - Port Development

150 North Wacker Drive — CHICAGO 6

SAN FRANCISCO — TORONTO — OKLAHOMA CITY

WALTER E. DEUCHLER ASSOC., INC.

Consulting Municipal Engineers

63 South LaSalle Street

Aurora, Illinois

FRIEDEWALD ENGINEERING CO.

Consulting Civil Engineers

311 South First Street

Belleville, Illinois

GOODKIND & O'DEA, INC.

Consulting Engineers

Foundations - Structures - Expressways
Flood Control

108 West Lake Street — Chicago 1, Illinois

GREELEY AND HANSEN

ENGINEERS

Water Supply - Water Purification - Sewerage - Sewage Treatment - Flood Control - Drainage - Refuse Disposal

14 EAST JACKSON BOULEVARD — CHICAGO 4, ILLINOIS

Charles W. Greengard Associates

consulting engineers

Deerfield, Illinois

CIVIL • SANITARY • MUNICIPAL • UTILITY
reports, plans, supervision, appraisals

PROFESSIONAL DIRECTORY

HANSON, COLLINS & RICE
Consulting Engineers

Registered Structural and Professional Engineers
Bridges and Grade Separation Structures - Dams
Soil Tests and Foundations - Roads and Streets

1622 South Fifth Street — **Springfield, Illinois**

HARZA ENGINEERING COMPANY
Consulting Engineers

Calvin V. Davis **Richard D. Harza** **E. Montford Fucik**

Reports • Design • Supervision
Hydroelectric Plants and Dams • Transmission Lines
Flood Control • River Basin Development • Irrigation

400 West Madison Street — **Chicago 6, Illinois**

HAZELET & ERDAL
CONSULTING ENGINEERS

Long Span Bridges • Expressways • Movable Bridges
Grade Separations • Airports

53 West Jackson Blvd. — **CHICAGO 4**

LOUISVILLE **CINCINNATI** **LANSING**

JENKINS, MERCHANT & NANKIVIL
CONSULTING ENGINEERS

Municipal Improvements — Gas Systems
Highways & Airports — Water Systems
Power Development — Sewerage Systems
Traffic Surveys — Industrial Plants
Flood Control — Recreational Facilities
Investigations and Reports

801-805 East Miller St. — **SPRINGFIELD, ILLINOIS**

LAND SURVEYS
INDUSTRIAL · COMMERCIAL · RESIDENTIAL

Legal Descriptions, Property Lines, Rights of Way, Subdivisions, Topography, Construction Lines, Grades.

S. PASQUINELLI, *Reg. Illinois, Indiana, Wisconsin*

NATIONAL SURVEY SERVICE, INC., *Reg. Engineers & Land Surveyors, 134 N. LaSalle RA 6-7608*

R. W. ROBINSON & ASSOCIATES
CONSULTING ENGINEERS

Surveying • Sewage & Water Systems
Complete Municipal Service
Mailing Address

357 East 170th Street
SOUTH HOLLAND, ILLINOIS
Phone Edison 1-6700

2445 S. Ridge Road
LANSING, ILLINOIS
Phone Granite 4-6868

RUSSELL AND AXON
CONSULTING ENGINEERS

Civil - Sanitary - Structural - Industrial - Electrical
Rate Investigations

408 Olive Street, St. Louis 2, Missouri

Municipal Airport, Daytona Beach, Florida

SARGENT & LUNDY
ENGINEERS

Consultants to the Power Industry

• STUDIES • DESIGN • SUPERVISION

140 South Dearborn Street, Chicago 3, Ill.

M. C. SEIBERLING, ENGINEER
Engineering Services

Phone 6-5814

155 Scott Street — **Joliet, Illinois**

HAROLD S. SHAFFER
CONSULTING ENGINEER
SOIL ENGINEERING SERVICES

Site Investigations - Borings - Soil Testing
Analysis - Design - Field Inspection
Engineering Reports - Consultation

1660 N. 21st St. — **Decatur, Illinois**

SILANDER & SON
Established 1906

Land Surveyors - Civil Engineers

Town and Industrial Planning and Engineering, Subdivisions, Surveys and Legal Descriptions, Drafting Services.

RAndolph 6-9899

228 North LaSalle Street — **Chicago**

SOIL TESTING SERVICES, INC.
CONSULTING ENGINEERS

Soil Investigations - Laboratory Testing
Foundation Recommendations and Design

1827 North Harlem Avenue — **CHICAGO 35, ILLINOIS**

Milwaukee, Wis. • Portland, Mich. • Kenilworth, N. J.
San Francisco, California • Havana, Cuba

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS

208 South LaSalle Street, CHICAGO 4, ILLINOIS
Hershey Building, MUSCATINE, IOWA
1154 Hanna Bldg., CLEVELAND 15, OHIO
Bank of Monrovia Bldg., Monrovia, Liberia, W. Africa

SVERDRUP & PARCEL ENGINEERING COMPANY
Engineers - Architects

Bridges, Structures and Reports
Industrial and Power Plant Engineering

915 Olive Street — **St. Louis 1, Missouri**

WIGHT and COMPANY
Consulting Engineers

Expressways • Bridges • Water Supply
Sewage • Municipal Improvements

1038 Curtiss Street — **Downers Grove, Illinois**

and

446 Main Street — **Barrington, Illinois**

C. K. WILLETT
CONSULTING ENGINEER

Complete Engineering Service for All Municipal Improvements

317 North Galena Avenue — **Dixon, Illinois**

Robin Lake dining pavilion, Ida Cason Callaway Gardens, Pine Mountain, Georgia. Architects: Aeck Associates, Atlanta, Ga. Structural Consultants: Drake, Funsten & Harrison, Atlanta, Ga.

Gay parasols of concrete add a festive touch to eating out

Conical bowls atop slender concrete stems create a roof that's unusual and dramatic. For a pavilion where informal meals are meant to be fun, these parasols give just the right atmosphere.

Only in concrete do such architectural flights of fancy become so down-to-earth practical. With its unique plasticity, concrete provides endless creative potential.

Architects today are finding more and more new uses for concrete—as a basic structural material of exciting natural beauty as well as great strength. It's stimulating a whole new trend in contemporary American structures.

PORTLAND CEMENT ASSOCIATION 111 West Washington Street, Chicago 2, Illinois

A national organization to improve and extend the uses of concrete